REMARKS

Claims 1-16 are pending in this application. By this Amendment, claim 1 is amended, and claim 16 is added. Support for the amendments and the new claim may be found, for example, in the specification at paragraphs [0007] and [0009]. No new matter is added. Reconsideration and allowance of the claims are respectfully requested in view of the foregoing amendments and the following remarks.

The courtesies extended to Applicant's representative by Examiners Po and McAvoy at the interview held June 24, 2010, are appreciated. The reasons presented at the interview as warranting favorable action are incorporated into the remarks below, which constitute Applicant's separate record of the interview.

I. Rejections Under 35 U.S.C. §103

A. Kamei

The Office Action rejects claims 1-7 and 10-12 under 35 U.S.C. §103(a) over U.S. Patent No. 4,702,745 to Kamei et al. ("Kamei"). This rejection is respectfully traversed.

Claim 1 recites:

> A method for dewatering and reducing pore volume of water-containing coal, comprising heating the water-containing coal at a temperature of 100°C to 350°C under a pressure not less than a saturated steam pressure at the temperature for the heating, while simultaneously applying a shearing force of 0.01 MPa to 20 MPa to the water-containing coal, in a sealed vessel.

Kamei would not have rendered obvious each and every feature of claim 1.

The Office Action asserts that Kamei discloses various features of claim 1. However, the Office Action concedes that Kamei does not disclose applying a shearing force. The Office Action asserts that a screw extruder, as allegedly disclosed in Kamei, "inherently provides a compression force as well as a shearing force, based on its design" and that "it

would be obvious...to use a screw, extruder type compressing-depressurizing unit to generate a shear force of 9.807 MPA since KAMEI teaches...that FIG 3 is an embodiment of compressing-depressurizing units" (Office Action, page 4). The Office Action also applies arbitrary definitions to the terms "shear force," "pressure," and "compression force."

Thus, for at least the reasons presented below, Applicant disagrees with the Office Action's assertion that Kamei allegedly provides a shearing force, and respectfully requests that the Office recognize the differences between pressure and shear force, as known to one of ordinary skill in the art, and supported by references offered during the interview.

Specifically, the Office Action appears to be treating these terms as synonymous or identical, without providing any clear, technical support or reasoning as to why these terms are being treated as interchangeable, contrary to their dictionary definitions, as discussed during the interview. In particular, the McGraw Hill Dictionary of Physics, 3rd ed., defines "shearing forces" as two forces that are equal in magnitude, opposite in direction and act along two distinct parallel lines; and defines "pressure" as a type of stress which is exerted uniformly in all directions (McGraw Hill Dictionary of Physics, 3rd ed. (2002)) (http://www.mhprofessional.com/dictionarlyofphysics/register.php). The McGraw Hill Encyclopedia of Science and Technology defines "pressure" as the ratio of force to area; and defines "shear" as a straining action wherein applied forces produce a sliding or skewing type of deformation. A shearing force acts parallel to a plane as distinguished from tensile or compressive force, which act normal to a plane (McGraw Hill Encyclopedia of Science and Technology, 9th ed. (2002)). Copies of the definitions from the McGraw Hill Encyclopedia of Science and Technology are attached for the Examiner's information. Pressuring and shearing are thus completely different. If the Patent Office disagrees, then a clear explanation for the disagreement should be provided.

Kamei is directed to a method for dewatering a high moisture porous organic solid by heating the organic solid at an elevated temperature and pressure, compressing the solid at the same temperature and pressure of the heating step, and lowering the pressure (depressurizing) while maintaining mechanical compression (Kamei, col. 2, lines 45-68). More specifically, and with reference to Figure 1 of Kamei, Kamei discloses charging brown coal into a heating chamber to dewater the brown coal at a high temperature and high pressure (Kamei, col. 5, lines 31-40 and Fig. 1). The dewatered coal is then discharged to a compressing-depressurizing unit that mechanically decompresses the dewatered coal (Kamei, col. 5, lines 43-50 and Fig. 1). One of the devices Kamei discloses to use to compress-depressurize the dewatered coal is a single screw extruder (Kamei, col. 6, lines 7-10 and Fig. 3). In the single screw extruder of Kamei, dewatered coal falls through a chute and into a compressing chamber, where it is then forced into a tapered mold by a forwarding screw (Kamei, col. 6, lines 7-13 and Fig. 3). The forwarding screw compresses the coal in a forward axial direction toward the opening of the extruder chamber (Kamei, col. 6, lines 13-27 and Fig. 3). As a result, back pressure generation is negligible in the single screw extruder of Kamei because all of the dewatered coal particles move forward, in the direction of the forwarding screw, as discussed during the interview. Thus, during the compressing-depressurizing step of Kamei, at best, an insignificant amount of shear force is generated, which is wholly insufficient to generate any meaningful amount of shear force that would result in collapsed pores or reduction in pore volume.

In contrast, the claimed method provides a method for both dewatering water-containing coal and preventing subsequent re-absorption of water or absorption of oxygen from occurring after the coal has been dewatered (specification, paragraphs [0006], [0009] and [0042]).

Water-containing coal has numerous pores present in its structure, which can become filled with water. Applying heat or a compression force can remove water from the coal, as disclosed by Kamei, by essentially compacting the coal and compressing water out from the coal's pores. However, coal is resilient. Thus, even in cases where a compression force is applied to dewater coal (see Kamei), the number of pores present in the coal still remains substantially unchanged. As a result, not only can the coal re-absorb water at some later point, but during transportation or storage the coal can also absorb oxygen gas. This causes gradual oxidation, which can result in spontaneous firing (specification, paragraphs [0002] and [0007]). In order to prevent dewatered coal from subsequent re-absorption of water and/or absorption of oxygen, it is necessary to substantially decrease the pore volume by collapsing a significant number of pores, and not just dewater the coal.

Claim 1 provides a method for de-watering water-containing coal by which re-absorption of water and absorption of oxygen is also prevented. This is achieved by heating the water-containing coal at a temperature of 100°C to 350°C under a pressure not less than a saturated steam pressure at the temperature for the heating, while simultaneously applying a <u>shearing force</u> of 0.01 MPa to 20 MPa to the water-containing coal, in a sealed vessel, as recited in claim 1. The application of a high shearing force is crucial because the mere application of a mechanical pressure, a load, compression or a compressive force, is simply not capable of collapsing any significant number of pores that are present in the structure of the coal, as discussed during the interview. In the twin shaft screw type kneader as shown in Figure 2 of the specification, coal is placed in the sealed vessel. Typical extruders have a constant pitch between blades, where the feed is continuously withdrawn from an exit, as with the screw extruder-type compressing-depressurizing unit of Kamei (Kamei, Fig. 3). By contrast, the pitch of the stirring blades of the twin shaft screw type kneader of the specification begins at 70 mm at the spot closest to the coal supply, and decreases in 4 mm

increments toward the downstream side, where the last pitch is 22 mm at the spot closest to the exit port (specification, paragraph [0023]).

During the dewatering treatment of claim 1, water-containing coal hits with force against the vessel wall at the end of the forward direction, and flows in the opposite direction. The backward moving coal then collides and shears off with another coal particle moving in the forward opposite direction, which is the foundation of the high shear force, as recited in claim 1. This high shear force breaks the adhesion and ionic bonds that bond clay particles present in the coal particles, destroys pores and, thus, inhibits absorption of oxygen or water once dewatering is complete.

With reference to Example 1 of the specification and the Declaration filed on December 18, 2009, water-containing coal was placed in a vessel at a pressure of 0.7 MPa and heated to a 170°C, at which point the pressure was immediately adjusted to 1MPa and a shearing force of 0.1 MPa was applied, in accordance with the method recited in claim 1 (specification, paragraphs [0029], [0032] and [0041]). The pore volume (percentage of void) of the coal decreased **68%** in the method of claim 1 (*Id.*). By contrast, in Kamei, hot, dewatered coal is fed into an extruder (compressing-depressurizing device) (Kamei, col. 6, lines 8-10). As a result, less slippage can take place inside the dewatered coal, which results in an insignificantly small amount of shearing - much less than 0.01 MPa.

The decrease in pore volume due to the application of shear force is nowhere disclosed in Kamei. Thus, Kamei provides no reason or rationale for one of ordinary skill in the art to have modified the reference in the exact manner necessary to obtain the claimed invention with any reasonable expectation of success. To assert that one of ordinary skill in the art at the time of the invention would have modified the method of Kamei to combine the dewatering step with the compressing-depressurizing of Kamei into a single step and apply a shear force in the manner recited in claim 1, without any indication in Kamei that application

of a shear force is even possible through its disclosed method or present, is impermissible hindsight reasoning based solely on Applicant's disclosure and does not constitute a showing of *prima facie* obviousness.

Further, during the interview, the Examiners asserted that applying a pressure, as disclosed in Kamei, and applying a shear force are allegedly equivalents in the art of dewatering coal. Applicant disagrees, and the Patent Office has not provided any evidence to support the assertion. In contrast, Applicant submitted the above dictionary definitions showing that pressure and shear force are not considered equivalent.

In order for the Office Action to rely on equivalence as a rationale supporting an obviousness rejection, the equivalency must be recognized in the prior art, and cannot be based on Applicant's disclosure or the mere fact that the components at issue are functional or mechanical equivalents. *In re Ruff*, 256 F.2d 590, 118 USPQ 340 (CCPA 1958) (MPEP §2144.06). Thus, Applicant respectfully requests that the Patent Office provide a reference or specifically cite any part of the applied references that disclose such a recognized equivalency as asserted during the interview.

Based on the above, Kamei would not have rendered claim 1 obvious. The remaining claims variously depend from claim 1 and, likewise, would not have been rendered obvious by Kamei for at least the reasons set forth above, as well as for the additional features they recite. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

B. Kamei , Verschuur and Gregory

The Office Action rejects claims 8 and 9 under 35 U.S.C. §103(a) over Kamei in view of U.S. Patent No. 4,216,082 to Verschuur ("Verschuur"); and rejects claims 13-15 under 35 U.S.C. §103(a) over Kamei in view of U.S. Patent No. 2,824,790 to Gregory et al. ("Gregory"). These rejections are respectfully traversed.

The Office Action applies Verschuur and Gregory as allegedly addressing additional features recited in dependent claims 8, 9 and 13-15. Thus, Verschuur and Gregory do not cure the deficiencies of Kamei with respect to claim 1.

Based on the above, Kamei with Verschuur or Gregory would not have rendered claim 1 obvious. The remaining claims variously depend from claim 1 and, likewise, would not have been rendered obvious by the applied references for at least the reasons set forth above, as well as for the additional features they recite. Accordingly, reconsideration and withdrawal of the rejections are respectfully requested.

II. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

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WPB:NAB/mjb

Attachments:
Petition for Extension of Time
Request for Continued Examination
McGraw Hill Encyclopedia of Science and Technology, 9th ed. (2002)); Definitions of "Shear" and "Pressure"

Date: July 23, 2010

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ENCYCLOPEDIA ARTICLE

Shear

Sections:

A straining action wherein applied forces produce a sliding or skewing type of deformation. A shearing force acts parallel to a plane as distinguished from tensile or compressive forces, which act normal to a plane. Examples of force systems producing shearing action are forces transmitted from one plate to another by a rivet that tend to shear the rivet, forces in a beam that tend to displace adjacent segments by transverse shear, and forces acting on the cross section of a bar that tend to twist it by torsional shear (**Fig. 1**). Shear forces are usually accompanied by normal forces produced by tension, thrust, or bending.

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ENCYCLOPEDIA ARTICLE

Pressure

Sections:

Pressure on a surface immersed in a fluid is defined as the normal force per unit area. Pressure always tends to compress the object on which it acts. This definition identifies the so-called static pressure p.

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